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# CONTRIBUTION OF SOVIET ASTRONOMY

by A. A. Mikhaylov

- USSR -





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# CONTRIBUTION OF SOVIET ASTRONOMY

[Following is the translation of an article by A. A. Mikhaylov entitled "Vklad Sovetskoy Astronomii" (English version above) in Priroda (Nature), No. 11, Moscow, November 1957, pages 79 - 88.]

Forty years ago the Great Socialistic Revolution, upon having changed the social and governmental organization in Russia, radically reformed all aspects of the national economy and culture. Science, in whose progress the tsarist regime was hardly interested, hindering its expansion in every conceivable manner among the broad masses of the population, wasgiven unlimited potentiality for rapid development under the Soviet system. Tremendous changes, both quantitative and qualitative, took place in scientific work, and astronomy was no exception in this regard. In order to demonstate all the modifications which have occurred with greater clarity, we will compare the current status of astronomy in the USSR with its position 45 - 50 years back.

Astronomy is an observational science and therefore depends to a significant degree on the implements

used for research, namely the diverse instruments and devices found at those special scientific research institutes, the astronomical observatories. Consequently, the number of astronomical observatories and the quality of their instrumentation can serve to a certain extent as an indicator of the level of scientific production in a given country.

During the past century several astronomical observatories were founded in Russia. The larger part of these were maintained at universities, chiefly for the purpose of providing instruction in astronomy. Such was the case with the observatories at Moscow, St.Petersburg, Kazan, Kharkov, Kiev, Odessa, Yurev and Vilnius Universities. There were also, apart from these, the independent observatories of the Academy of Sciences at Pulkovo near St. Petersburg, with two southern branches at Nikolayev and Simeiz, and the Tashkent Observatory which had belonged at first to the War Ministry.

It should appear that with such a considerable number of observatories scientific work in astronomy might have stood at a high level and been conducted at a rapid pace. However, if one leaves out Pulkovo Observatory, this was certainly not the case. The reason for this was, on the one hand, the extremely small staffs at the observatories, and on the other, the total lack of planning and coordination of operations. The instrumentation at the majority of the observatories was basically astrometrical and was kept at the level of the middle or second half of the last century, practically without being replentished or modernized. It was only Moscow Observatory which succeeded, through the efforts of Professors V. K. Tseraskiy and P. K. Shternberg, in being renovated and enlarged at the outset of the Twentieth Century.

Research work at the observatories was conducted at that time on the basis of personal initiative, energy and capability of the individual scientists who were usually professors at the particular universities. At this point one could name the most outstanding astrophysicists F. A. Bredikhin and A. A. Belopol'skiy, and later V. K. Tseraskiy at Moscow, M. A. Koval'skiy, an expert in stellar astronomy, at Kazan, the precision astrometrist N. N. Yevdokimov at Khar'kov, the indefatigable observer and outstanding teacher M. F. Khandrikov at Kiev and a number of other individual scientists. As a result of their studies in certain branches of astronomy, exceptional research was indeed made, although on the whole

the status was mediocre. Astrometrical instruments remained to a considerable extent idle, and there just were not any astrophysical instruments to speak of. It was only at Pulkovo Observatory that the operations proceeded at a very intensive rate and with the transfers of F. A. Bredikhin and A. A. Belopol'skiy to there astrophysical investigations began to progress with the application of methods which were new at that time: photography, photometry and spectral analysis.

The First World War, bringing disorder in its wake, and then the civil war, quite naturally, retarded scientific work in astronomy. The serious situation of the young Soviet government in regard to the allotment of supplies and its difficult economic problems did not allow the rapid reconstruction of observatories nor the advancement of the science of astronomy. Notwithstanding one important goal was slowly realized, the staffs of the astronomical institutions were considerably expanded, thus making it possible to intensify observations and to attract talented youths, from among whose ranks many of today's leading scientists have in the course of time evolved.

Still other reforms rapidly followed. The need to supply Soviet astronomy, geodesy and navigation and later on air navigation with astronomical ephemerides and tables led to the organization of a new institution at Petrograd, the Computation Institute, subsequently changed into the Institute of Theoretical Astronomy of the Academy of Sciences USSR, while at Moscow the Astronomic-Geodetic Institute for Broad Relief was founded at the university. Whatever replentishment of instrumentation was done, could only be performed for Pulkovo Observatory and its Simeiz Division due to the absence of domestic optical machine manufacture. It then turned out that large instruments which had been ordered in England even before the revolution were ready; with the aid of People's Commissar of Foreign Trade L. B. Krasina all formalities were surmounted and in 1924 Pulkovo was outfitted with the large Littovskiy spectrograph with a coelostat for solar research, and at Simeiz a superb 40-inch reflector was installed. The 32-inch astrograph which was ordered was not yet finished and only a single mounting was delivered, which was destroyed at the time of the Great Patriotic War (World War II).

Then, new astronomical institutions began to be created, new centers of scientific investigation in

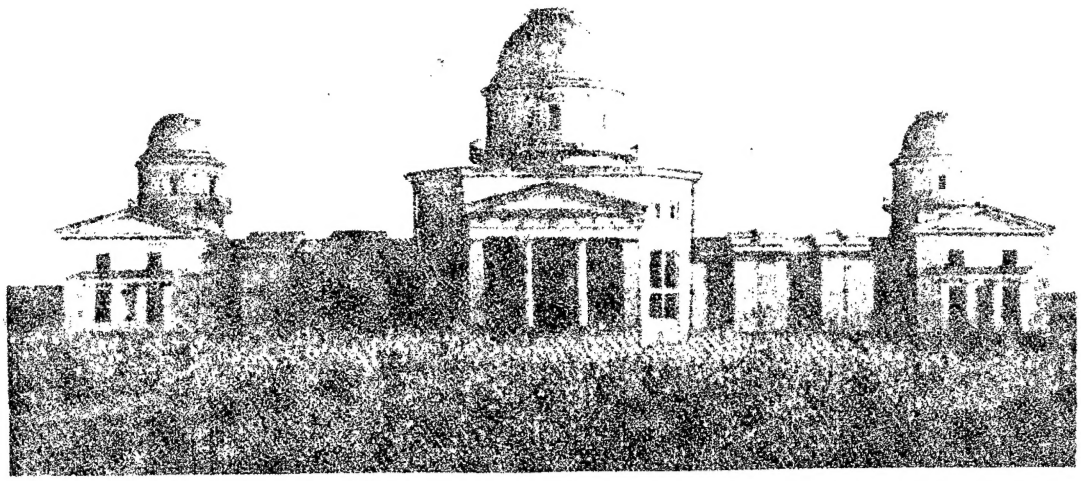
various Soviet republics. Thus, it was in the Ukraine at Poltava, that the Gravimetric Observatory was founded through A. Ya. Orlov's initiative, which, aside from its immediate purpose of studying the gravitational force undertaking gravimetric surveying of the Ukraine, also observed lunar and solar tides in the earth's crust and the migration of the terrestrial poles.

The lack of modern astrophysical observatories in the southern USSR drastically limited the possibility of investigating many areas in astrophysics and sidereal astronomy. In view of this, an organizational committee was created in Moscow as early as 1920 to select a site and to build an astrophysical observatory, which as a result however of the impossibility of obtaining large instruments was forced to restrict itself to theoretical work; this was reorganized later on as the State Astronomical Institute. In 1931 three Moscow astronomical Institutions: the University Observatory at Presne, the Astronomical Geodetic Institute at Moscow State University and the State Astrophysical Institute were merged to form the huge scientific research and auxiliary training institution, the State Institute imeni P. K. Shternberg, named in honor of the revolutionary astronomer who was a professor at Moscow University.

However for the successful development of this important branch of science, an astrophysical observatory was required in the south of the country. Owing to the initiative of the Astronomical Institute in Leningrad it was possible to overcome the difficulties involved and to organize an astrophysical observatory in the Transcaucasus, on a mountain overlooking the famous resort of Abastumani. Among the instruments installed there were the 12-inch Zeiss refractor with short focus photographic cameras and the 13-inch reflector made at the workshop in the Leningrad institute. This constituted the founding of the present Abastumani Astrophysical Observatory of the Georgian Academy of Sciences which rapidly became a major research center for sidereal astronomy, particularly for the determination of star coloration. Then the small observatory at Stalinabad was set up for observing variable stars and meteorites.

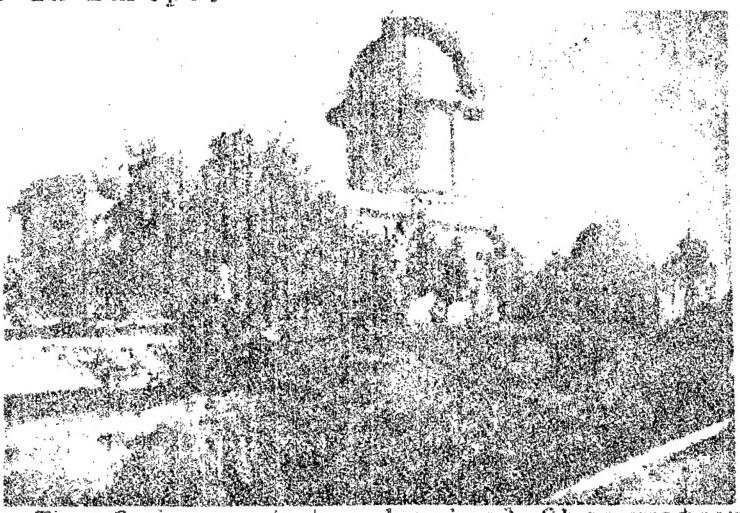
Upon discovering the periodic migration of the earth's poles at the end of the last century, it was decided by international agreement to set up in different parts of the globe astronomical stations equipped with

instruments of a single type and distributed along a single common parallel at 38° 08' north latitude. One of these international latitudinal stations was located at Chardzhu (now Chardzhou) on the shore of the Amu-Dar'ya River. The identical latitude of these stations was necessitated in order to observe the very same stars while making itspossible to eliminate a number of systematic errors. Central processing of the observations plots with a high degree of accuracy the movement of the terrestrial poles, which it is essential to know in order to correctly apply astronomical observations and, moreover, provides great interest to geodetics in giving information on the mechanical properties of the terrestrial sphere. The Chardzhou latitudinal station ceased operations in 1919 partially because of washout of the river which had shifted its bed and come right up to the astronomical pavilion. A new latitudinal station at Kitab was opened later in Uzbekistan also, instead of the Chardzhou Station, on the same latitude; this is now an affiliate of Tashkent Observatory.



The Reconstructed Main Building of Pulkovo Observatory

Nevertheless, despite this addition of new observatories, the material basis of Soviet astronomy still continued to remain insufficient. For deeper investigations into the physical properties of the stars, the structure of the galaxy, and all the more so for studies in the realm of extra-galactic astronomy tremendously more powerful instruments were required than those which Soviet observatories then had at their disposal. Actually, the most powerful 40-inch reflector in the USSR located at Simeiz was the fifteenth most powerful in the world. Meanwhile, the domestic optical machine industry had developed during the years of the five-year plans to such a extent that it was able to undertake the manufacture of the most powerful and complex telescopes. An excellent sample of their capacities may be seen in the large Ponomarev-Maksutov solar horizontal telescope which was built at the Leningrad workshop and installed at Pulkovo in 1940, and was the largest instrument of this type in Europe.



The Crimean Astrophysical Observatory. Building of the Turret Solar Telescope and Coronograph Turret.

Toward the end of the thirties the problem was deliberated at the Academy of Sciences of reconstructing an observatory base and structure in the south of the USSR for an up-to-date astrophysical observatory. The war which suddenly burst out not only deferred this intention, but also brought great damage to Soviet

astronomy. The largest observatory in the land at Pulkovo and its Simeiz division were completely destroyed by the Fascist invaders, the most complex instruments, the large refractor and solar telescope at Pulkovo, as well as the 40-inch reflector at Simeiz, were ruined. But even before the victorious conclusion of the Great Patriotic War, the Soviet government had decided to restore Pulkovo Observatory at its historic site and to build up the large astronomical observatory in the liberated Crimea. Construction began at Pulkovo in 1946 according to Academician A. V. Shchusev's architectural plans. New walls were erected on the old remaining foundations of the main observatory building. The main building was restored along the former classical lines and only the cupola with three turrets became the modern hemispherical form instead of the previous cylindrical shape. Toward the south and east of the main building there spreads out an entire town of pavilions and turrets for various instruments, auxiliary and household installations and living quarters for the staff members. Alongside several old, reconditioned and modernized instruments, many new ones have been installed, the larger part of which have been manufactured at Leningrad factories. The pre-war level has been nearly three times surpassed in abundance of instrumentation, cubic space of the buildings and the number of coworkers at the observatory.

The Simeiz Observatory which was previously an affiliate of the Pulkovo Observatory was after its restoration made part of the new large astrophysical observatory of the Academy of Sciences USSR, the main portion of which was built near Bakhchisaray in the foothills of the Crimean Peninsula. Well outfitted with an excellent set of instruments, including a vertical solar telescope, double illumination astrograph, 125-centimeter reflector, 50-centimeter meniscus telescope, the Crimean Astrophysical Observatory has filled an existing gap in regard to providing a well equipped base for astrophysical investigations. Our optical machine industry is currently preparing for this observatory a parabolic reflector with a 2.6 meter mirror diameter which will be the third largest in size in the world. Preparatory studies are now being made at Pulkovo for producing a still larger telescope.

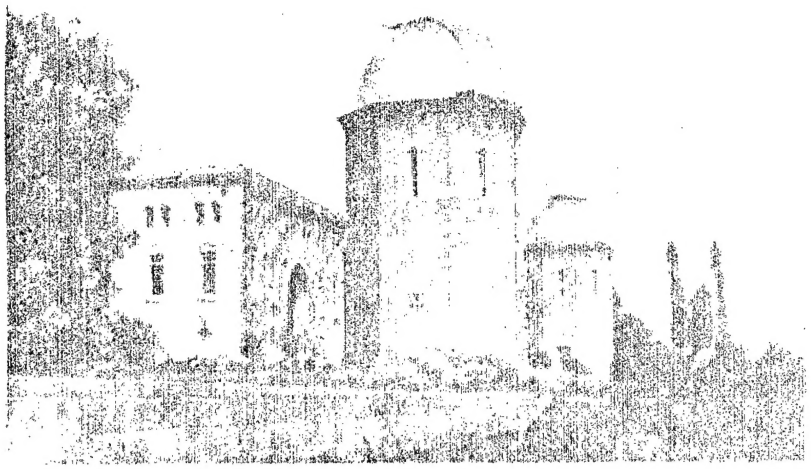
Together with these large observatories which form part of the system of the Academy of Sciences USSR

there have been established in the post-war years observatories on a somewhat smaller scale in a number of the union republics: near Kiev there is the Main Astronomical Observatory of the Academy of Sciences Ukrainian SSR near Alma Ata there is the Astrophysical Observatory of the Kazakh Academy of Sciences, at Ashkhabad -- the Astrophysical Laboratory, near the capitol of Armenia, in Byurakan, an observatory for astrophysical stellar research has been built. The observatory of the Astronomical Institute imeni P. K. Shternberg, generously equipped with the latest instruments of domestic manufacture, was erected alongside the new building of Moscow University on the Lenin Hills in Moscow. In the Caucasus, near Kislovodsk, at a height of 2,130 meters above sea level, the solar station of Pulkovo Observatory was set up; this now conducts non-eclipse observations of the solar corona and regularly observes photospheric and chromospheric phenomena on the sun. Another coronal station was built at a still greater altitude near Alma Ata. In connection with IGY studies an observatory was set up at Blagoveshchensk on the Amur to investigate the migration of the earth's poles, under the direction of Pulkovo Observatory. It was decided to construct an astrophysical observatory near the city of Shemakha in Azerbaydzhan. Many other observatories were outfitted with unique new instruments, among which it is imperative to mention Abastumani Observatory, provided with the remarkable 70-centimeter meniscus telescope designed by B. K. Ioannisiani, laureate of the Lenin prize. This instrument whose optical system was calculated by D. D. Maksutov is distinguished by a large plane field with superb images and fully automatic controls. It is provided with an objective prism which covers the entire meniscus aperture, nearly the largest in the world.

Thus, during the years of Soviet regime and especially during the past 12 years astronomical science in the USSR has been provided with several new observational bases and equipped with many up-to-date and improved instruments of domestic manufacture. The plan of optical instrument production is providing for the further expansion of its output so that in the coming few years the instrumentation of Soviet observatories will be still further augmented.

Nonetheless, astronomical observatories and instruments are the means, rather than the end, despite the

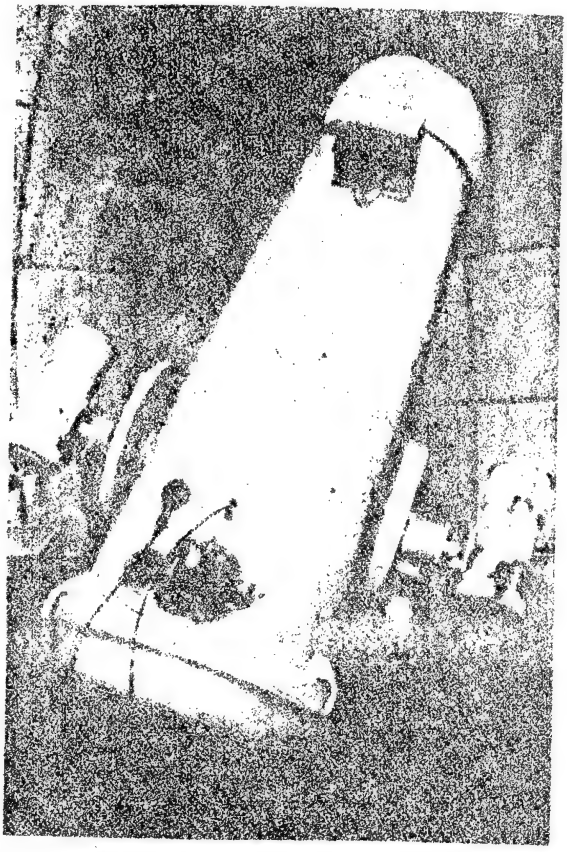
fact that they are quite indispensible for progress in the science. It is therefore necessary, after having presented this concise information on new observatories and instruments, to give a brief survey of scientific attainments of Soviet astronomy. But the author is confronted at this point with great difficulties, even the impossibility of fulfilling this task. For the truth is that during forty years of continuous growth in personnel and expansion of scientific studies, so much has been accomplished that a voluminous book would be needed to contain even a brief description of the methods and attainments of Soviet astronomy. It will therefore be more proper to limit ourselves to the most cursory and by far incomplete mention of several findings, stipulating beforehand that such an arbitrary listing should not by any means be regarded as a criterion of the significance of the work which has been done.



Byurakan Astrophysical Observatory. Laboratory building with observation towers.

Were one to wonder what the fundamental characteristic of the trend of operations during the Soviet period has been, that which distinguishes it from the

pre-revolutionary work, it would be properly summed up in the word "collectivity". Actually, whereas previously every observatory, each scientific center in the field of astronomy worked in isolation to the extent of its power and potentialities, or it is better to say to the measure of its inclination, today all work is performed in close and continuous contact of all Soviet observatories and astronomers with one another according to mutually agreed plans, and on a wide range of problems as well as on an international scale of collaboration. Soviet astronomers have now been so engaged in collective operations and research, planned on an an all-union scale, so used to considering such an order of operations the only possible one, that it would be difficult for them to even imagine the disconnectedness which prevailed before the Great October Revolution.



Meniscus Telescope at Abastumani Astrophysical Observatory.

Another characteristic may be found in the purposefulness of the work. While the majority of research was formerly conducted according to individual tastes and the inclinations of individual scientists, today Soviet astronomers jointly work upon subjects of the greatest immediate importance for the national economy, as well as collectively tackling the most important thorny problems of science.

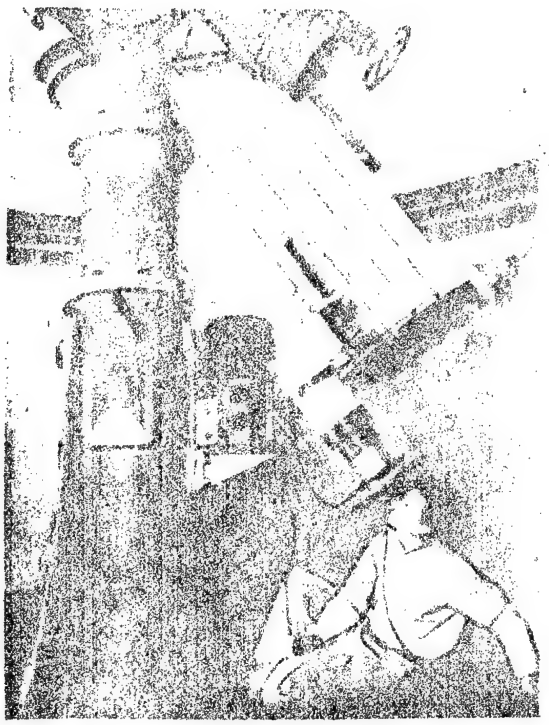
In regard to collectivity, one one bear in mind three primary services, the so called regular observation for practical utilization of a specific range of con stantly changing phenomena. These are the Latitude Service, Time Service and Solar Service. All of these are closely related to the work undertaken according to the IGY plan.

The Latitude Service was begun with observations on the variations in geographic latitude at Pulkovo fifty years ago. After the establishment of the gravimetric observatory these observations were also made at Poltava. Its purpose consists in studying the complex movement of the terrestrial poles, which is great interest to geophysics, goelogy, as well as astronomy and geodesy, since the earth's poles determine the position of the coordinate network of meridians and parallels on the earth's surface. In 1930 the latitude station at Kitab began to be constructed, and then observations commenced at Kazan'. However, the observations made from these points were inadequate in explaining the pole movement; it was necessary to also have at least one latitude station in the Far East, at a distance of about 90° in longitude from the European stations. For this purpose a station was set up in Blagoveshchensk, and regular observations were begun at Irkutsk as well; to strengthen the European stations Moscow was included in the observations. Besides this, a latitude station was built with the help of Soviet scientists on the international parallel at Tientsin (Chinese People's Republic) and at the latitude of Irkutsk a station was opened in Poland, near Poznan. These stations, embracing more than a quarter of the parallel's circumference in longitude, offers reliable data for studying and utilizing the motion of the terrestrial poles. At one of the Leningrad factories seven single-type large zenith telescopes of an improved design were prepared for six Soviet observatories and the Tientsin station.

The second important function, the Time Service, was begun in 1920, when Pulkovo Observatory began to transmit precise time signals over radio. Gradually developing and improving, there are now 12 Soviet observatories which participate in recording and determining corrections of the numerous time signals given by observatories throughout the world, while three observatories, Moscow, Tashkent and Irkutsk send time signals by radio which provide all scientific, technical and civil needs with the correct time. The increased accuracy of Soviet time services was promoted by the invention by Professor N. N. Pavlov at Pulkovo of a method of registering sidereal meridian passage with a photocell which replaces the human eye and its accompanying errors.

The Third Service, the Solar Service, which consists of observing events in the solar photosphere, chromosphere and corona, is of great significance in selecting wavelengths in radio communication, in investigating the ionosphere and terrestrial magnetism. A number of Soviet observatories are included in these observations, the observations are centrally processed and the findings published in the form of a solar bulletin in which the distribution of all observed phenomena on the solar disc is reported for every day. Soviet optical machine industry has provided the observatories with special instruments, with photoheliographs, coronographs and chromospheric telescopes.

In the field of astrometry certain cooperative work of international significance has been accomplished and is being done. For the needs of our geodesists in determining astronomical points of reference, a "Catalog of Geodetic Stars" has been published which contains 2,957 stars up to the 6m magnitude, compiled with the participation of five Soviet observatories under the direction of Pulkovo. Pulkovo Observatory has compiled, with the aid of a special instrument, the zonal coronograph, a catalog of 11,322 stars of the polar region of the heavens which is a part of an international undertaking. Soviet astrometrists are currently working with their foreign colleagues on observations and compilation for a large "Catalog of the Faint Stars", entitled as such because it basically lists stars between the 7m and 9m magnitudes, the general number surpassing 20 thousand. These stars have been selected in a specific manner and are uniformly distributed throughout the entire sky.



Byurakan Astrophysical Observatory.
Observing with the 21-inch telescope.
Photo: A. Ekekyan (TASS)

The ordinary catalogs contain stars which very different geometric and physical properties: different temperature and spectral classes and, in connection with this, different coloration, different densities and at the most diverse distances from us, moving at different, sometimes extremely great velocities. This variegation heavily limits the possibility of using the catalogs, falsifies their utilization for statistical purposes and increases observational errors. The new catalog will be free of these disadvantages, consisting of similar distant stars with very small proper motions. Seven Soviet observatories participated initially in observations for this catalog. There are now more than a score of observatories on four continents taking part, while Pulkovo Observatory is as before at the head. To establish as many invariable inertial coordinate systems as possible, the catalog

stars are "fixed" by photographic observations to select extra-galactic nebulae, which owing to their enormous distances from us which measures many millions of light years appear practically immobile to us. Finally, to eliminate systematic errors in stellar declinations and positive determination of equatorial points specially chosen planetoids are observed.

At Pulkovo Observatory extensive studies have been made by the photographic method of the proper motions of the stars in selected areas of the heavens. Fortunately, the plentiful legacy of the indefatigable astrophotographer S. K. Kostinskiy survived the war in the form of a large number of negatives of the starry heaven, taken 40 - 50 years ago on the Pulkovo standard astrograph, the best instrument of its type among all the existing ones. After the war the missing parts of the instrument were restored and the former regions of the sky rephotographed, thus making it possible through comparison of the new photos with the old ones to measure with great precision the proper motions of a number of interesting stars, as well as to make an extraordinarily accurate study of the invisible satellite of the binary star 61 Cygni, which resembles a planet more closely than a star in its mass and, apparently, its physical properties. A new 65-centimeter refractor has very recently been put into construction, which will be used to measure binary stars, determine sidereal parallaxes as well as to observe the large planets, especially Mars at the time of favorable opposition in 1958.

It was only upon having surmounted enormous difficulties that we have made exemplary progress in computing ephemerides. During the civil war and period of foreign intervention, when the young Soviet state was cut off from the rest of the world, the situation where ephemerides were required for astronomy, geodesy and navigation proved catastrophic. A certain improvement in this important matter was brought about upon the formation of the Computation Institute, which began to calculate and publish the most necessary ephemerides. The Astronomical Almanach published gradually came to be improved and expanded and is not surpassed today in plentitude of content by the largest and best of foreign ephemerides, beating them by a couple of years in publishing date and better than them in satisfying the demands of our geodesists. Together with this, it is

entirely calculated at the Leningrad Institute of Theoretical Astronomy of the Academy of Sciences USSR without any borrowing from foreign ephemerides, which does not, however, exclude close international cooperation with the ephemeris bureaus of France, England and the USA. It is particularly necessary to call to mind the ephemerides of the minor planets which are also calculated at this institute in accordance with an international commission in connection with a convenient and accurate method which it has worked out to compute perturbations produced by the major planets. Simeiz Observatory has made itself famous for its discovery of planetoids, where on the whole 140 new planetoids have been discovered.

Neglecting many more individual attainments in astrometry, we will now turn to the rapidly developing field of astrophysics. The works which have been achieved here are so very numerous and diversified that within the framework of the present article it is only possible to briefly mention a few of these. Stellar spectrospopy was conducted before the revolution chiefly at Pulkovo Observatory and its Simeiz Division. There was compiled here already in the Soviet period a large catalog of radiation velocities of the most difficult to observe stars of the early spectral classes which do not contain sharply defined lines in their spectra. At Pulkovo and Simeiz investigation was made of a number of especially interesting spectroscopic binary stars, and a significant content of the heavy carbon isotope $C^{13}$ was discovered in the atmospheres of certain cold stars. During the post-war yearsspectroscopy came to be widely utilized in investigating the sun, stars, nebulae and planets at Pulkovo and Crimean Observatories. Large scale studies in star colorimetry have been made at Abastumani Observatory, while at the Crimean Observatory a photoelectric catalog of stellar magnitudes has been compiled with unsurpassed accuracy.

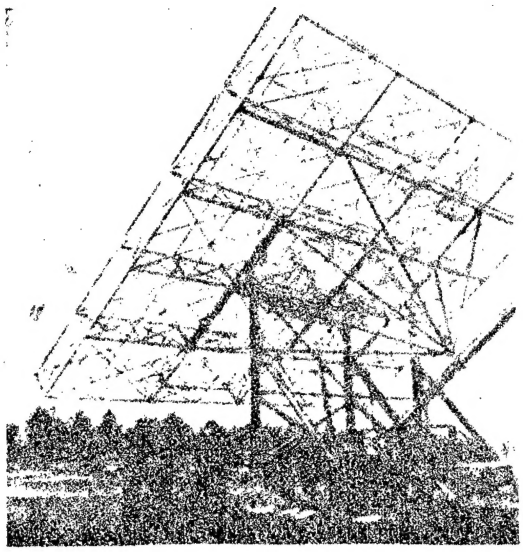
Since 1936 the paths of several total solar eclipses have passed through the territory of the USSR, the observation of which has been extremely interesting. Never before in the history of science has there been such extensive and well planned preparation for observing these eclipses. Previously, and indeed even today in the capitalist countries, the observation of eclipses was a matter for individual observatories, which independently of one another made these observations on the basis of subjects of interest and practicable to them.

It was on an entirely different basis that our observations were organized for the eclipse of 19 June 1936, the path of the total phase of which passed from west to east through all of the USSR, from the Black Sea to the Far East. A special commission of the Academy of Sciences USSR after having inquired at all Soviet observatories conducted a general programming and coordination of all astronomical and geodetic observations, worked out the types and ordered numerous new instruments and distributed these among the interested observatories.

This commission also districted all of the expeditions so that in the event of bad weather at a single locality, analogous observations could be made at other places which had more favorable meteorological conditions. As a result of these measures the observations of these eclipses yielded abundant data, especially in regard to the structure of the sun's corona and the motions which occurred in it. For eclipses not visible in the USSR more complex expeditions were outfitted in Sweden and Norway in 1927 and in Brazil in 1947, where it was determined for the first time that solar radio emission is not limited to the photosphere, but also has sources in the corona, so that total eclipses are not required for radio waves but rather all eclipses either annular or partial.

In regard to research on the other bodies of the solar system, the major planets, comets and meteors great success has also been attained. The problem of life on Mars has been the subject of animated discussion, in which G. A. Tikhov's investigations on the existence of plants in conditions of extreme temperatures and low moisture content, close to the severe climate of Mars, have proven to be of extreme interest. Several Soviet astronomers have successfully developed the theory of the structure of comets, created by F. A. Bredikhin. Thorough investigation was made of the places where two remarkable meteorites fell -- the Tungusskiy which fell in 1908 but was traced only during the Soviet period, and the Sikhote-Alinskiy which fell in 1947.

The beginning of extensive research on the variable stars whose value cannot be overrated in the study of stellar physics and the structure of the universe was laid at Moscow Observatory even before the revolution by the labors of V. K. Tseraskiy and his indefatigable assistants L. P. Tseraskaya and S. N. Blazhko.



Radio Telescope of the Laboratory of Solar Radio Emission. The Institute of Terrestrial Magnetism, the Ionosphere and Radio Wave Propagation.
Photo: M.Red'kin (TASS)

Continued by their students, this branch of astronomy was developed to such an extent during the Soviet times that the international center for cataloging variable stars shifted from Berlin to Moscow.

The new technology has begun to implant itself more and more widely in the practice of astronomical observations. The application of electronics, especially photoelectricity, multipliers and television techniques have opened broad possibilities of exploring phenomena which were just a short while ago inaccessible to observation. Thus, coworkers at the Crimean and Pulkovo Observatories were able to investigate in the infra-red region of the spectrum the light absorbing haze and to discover the central core of the Galaxy in the constelations of Sagittarius and Scorpio. By employing narrow light filters and polaroids, G. A. Shayn and his coworkers

discovered new gaseous nebulae and worked out a method for differentiating them from dust nebulae. This marked the beginning of the study of cosmic magnetic fields. Simulataneously with the American astronomer Otto Struve, he made the fundamental discovery of the rotation of stars around their axes.

Important work was made in investigation of new stars and planetary nebulae, particularly, a method was developed for determining the temperature of the latter. Theoretical research on the internal stnucture of stars is also interesting. A new leaf in astronomy has been uncovered by the studies of V. A. Ambartsumyan who has distinguished with his colleagues at Byurakan Observatory special star groups with common physical properties and common origin, called stellar associations. Together with V. G. Fesenkov's discovery of beadlike threaded stars / globular clusters/ in the filament of eertain nebulae, these studies bring us right up to the puzzle of the formation of the stars. Interesting.work has been done on the structure of interstellar environment and the absorption of light in space. The role of this environment is extremely important for a study of the galactic structure and for the problem of the origin and development of the stars.

The problems of the origin of the solar system and cosmogony in general has occupied several outstanding Soviet astronomers. Among these one should mention O. Yu. Shmidt whose merit consists in his having stimulated through his works research in this most difficult and significant field of natural science.

During the past 10 - 15 years a new branch of the science, radio astronomy, has arisen and been developed, having given man a second sight, many times extending the range of perception of electromagnetic waves in comparison with the human eye. By means of radio waves emitted by certain heavenly objects, data is gotten on processes occurring in the universe which are of great significance to the entire physical world. Soviet scientists have contributed heavily to the theoretical development of radio astronomical methods and in interpretation of the findings. A certain lag in the experimental part, requiring huge radio telescope antennas, was rapidly overcome through the installation of large radio telescopes in a number of observatories, among which the Pulkovo telescope has the highest

resolving power of all existing installations.

The achievements of Soviet astronomy are great and diverse. Due to its significant contribution to world science, the thoroughgoing elaboration of many current outstanding problems, the strict scientific treatment on a materialistic foundation, Soviet astronomy has enjoyed high prestige among the world scientific community and its part in the largest organization, the International Astronomical Union, is very large and continues to grow. In its turn, the tenth session of this Union will take place in August 1958 at Moscow. This will still further strengthen the international ties between Soviet astronomers and their foreign colleagues and will surely do its bit to further the great cause of strengthening peace among the peoples of the earth.

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